Integrated Resource Inventory

Alberta
ENERGY AND
NATURAL RESOURCES
Resource Evaluation
and Planning

PHYSICAL LAND CLASSIFICATION OF THE SANG LAKE GRAZING RESERVE

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This report is to be used in conjunction with the 1:21 120 scale Physical Land Classification (PLC) map of the Sang Lake Grazing Reserve. The map is available from the Alberta Map and Airphoto Distribution Centre, 2nd Floor, North Petroleum Plaza, 9945 - 108 Street, Edmonton, Alberta, T5K 2C9.

ABSTRACT

The Sang Lake Grazing Reserve covers 62 km^2 of Township 52, Range 15, West of the 5th Meridian in western Alberta. A physical land classification (PLC) of the grazing reserve initiated in 1980 was based on information derived from air photo interpretation, field work and literature reviews. The information was classified within a framework of a four-level hierarchy developed by the Land Classification Section, Resource Evaluation and Planning Division, Alberta Energy and Natural Resources. The four levels in successive order are the physiographic region, physiographic subregion, geomorphic system and geomorphic unit.

The grazing reserve lies within the Western Alberta Plains Physiographic Region. The reserve is subdivided into morainal upland and morainal-organic lowland subregions. The upland consists of fine textured continental till while the lowland is flatter and has more organic deposits. Soils mapped in the study area fall within the Luvisolic, Gleysolic and Organic orders.

Key Words: Sang Lake, Edson Forest, Alberta, grazing reserve, physical land classification, landforms, surficial geology, soils.

TABLE OF CONTENTS

		Page
1.	INTRODUCTION	1
	1.1 Location	1
	1.2 Bedrock Geology	1
	1.3 Quaternary History	1
2.	METHODOLOGY	4
	2.1 Physical Land Classification Guidelines	4
	2.2 Interpretation and Field Procedures	4
3.	PHYSICAL LAND CLASSIFICATION	7
	3.1 Alberta Plains Physiographic Region	7
	3.2 Physiographic Subregions	9
	3.2.1 Morainal Geomorphic System and Units	9
	3.2.2 Organic Geomorphic System and Units	14
GLOSSARY		17
LIST OF REFERENCES		23

LIST OF ILLUSTRATIONS

Figure		Page
1.	Regional Location Map	2
2.	Location of the Sang Lake Grazing Reserve within Dumanski et als (1972) Physiographic Subdivisions	8
3.	Topographic Expression of the Sang Lake Study Area	10
4.	Physiographic Subregions and Geomorphic Systems	11
5.	Schematic Distribution of Terrain and Soils in an Organic Unit to Morainal Unit Sequence (not to scale)	13

LIST OF TABLES

Table		
1.	Levels of Classification	5

PREFACE

This study was requested by the Land Management and Reservation Section of the Alberta Department of Energy and Natural Resources to assist in their management of the public lands in the study area. The Physical Land Classification information is also useful to agencies managing and monitoring specific resources such as forestry, fish and wildlife and agriculture.

ACKNOWLEDGEMENTS

The assistance of P.M. Ojamaa, Resource Appraisal Section and T.R. Bossenberry, Regional Planning Section of the Resource Evaluation and Planning Division is greatly appreciated. Many thanks to N.R. Rodseth, superintendent of the Edson Forest and his staff for providing information on the study area. Constructive criticism provided by the Land Classification Section staff is also appreciated.

1. INTRODUCTION

1.1 Location

The Sang Lake Grazing Reserve is a 62.2 km^2 rectangular tract of land which includes Sections 1 to 4, 9 to 16, 21 and 33 to 36 in Township 52, Range 15 west of the 5th Meridian. It is located approximately 38 km east-south-east of Edson and 160 km west of Edmonton (Figure 1). Access by automobile is limited to a gravel road running along the eastern perimeter of the study area. Travel is possible along cut lines if one walks or uses an all-terrain vehicle.

1.2 Bedrock Geology

The dominant bedrock underlying the grazing reserve is the Paskapoo formation of Paleocene and Upper Cretaceous age. The formation consists of thick, gently-dipping strata of weakly-consolidated sandstones interbedded with mudstones and siltstones. There are no exposures of bedrock in the study area because of a thick mantle of glacial till which covers the Paskapoo Formation.

1.3 Quaternary History

Laurentide continental ice covered the entire study area and surrounding vicinity during the Pleistocene epoch (Roed, 1968). The surficial material deposited by the ice was a slightly stony, fine textured basal till

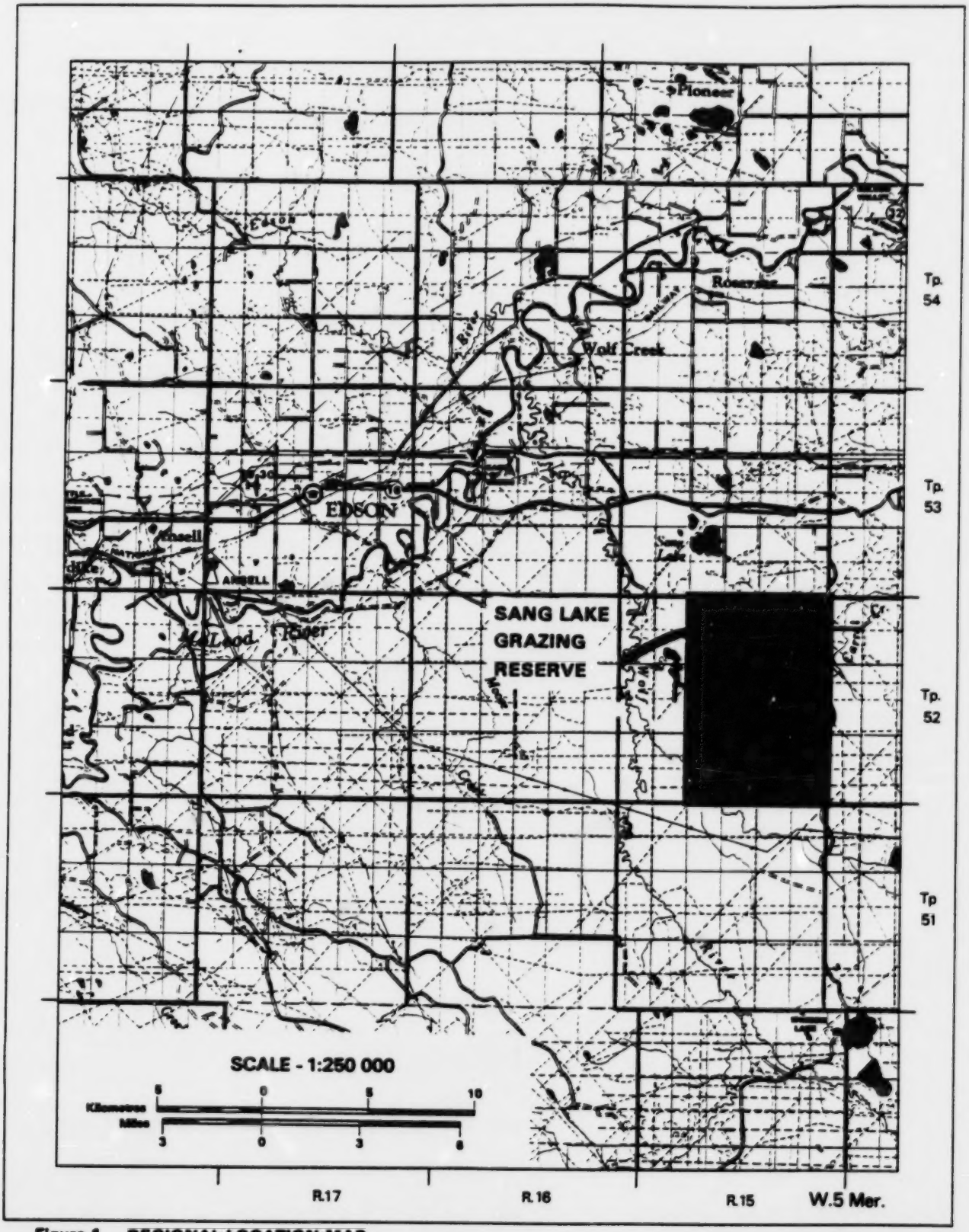

Figure 1 REGIONAL LOCATION MAP

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referred to as the Edson till. The few quartzite, granite and metamorphic stones of Canadian Shield origin provide proof that the ice masses which covered the area were continental in origin. The western limits of continental glaciation at its closest point to the study area is approximately 15 km to the southwest. Along this westerly limit, continental Edson till comes in contact with Marlboro till laid down by Cordilleran ice (Roed, 1968).

The continental ice retreated from the study area approximately 11 000 to 12 000 years B.P. (Prest, 1972). The direction of ice retreat was northeast. The terrain exposed after deglacation consisted of undulating to rolling basal moraine with a random pattern of shallow, poorly-drained, water-filled depressions. These depressions became eventual habitats for bog and fen type vegetation. The present physical landscape consists of upland areas covered with Edson till separated by shallow depressions infilled with organic deposits.

Drainage in the study area is generally west into Wolf Creek which is approximately 2.5 km west of the study area. A network of narrow stream courses draining west is evident in the southern portion of the study area. Elsewhere in the grazing reserve, stream development is less evident.

2. METHODOLOGY

2.1 Physical Land Classification Guidelines

The physical land classification (PLC) methodology (Land Classification Section, 1977) has been developed to meet the physical land resource data requirements of the resource planning and management agencies of Alberta Energy and Natural Resources and other government and research organizations. Comprehensive resource evaluation and planning requires physical land data as a primary component of any environmental study. Data are obtained by implementing a methodology which classifies the physical landscape according to its mode of origin, composition and form.

The methodology is based on a four-level hierarchy (Table 1). The classification starts at the broadest and most general level (physiographic region), progresses through the hierarchy and ends with the delineation of highly-detailed geomorphic units. This hierarchy provides a logical framework which allows for the subdivision of delineated areas at one level into more detailed areas at the next lower level.

2.2 Interpretation and Field Procedures

The identification and classification of the physical land parameters of any study area requires the acquisition, interpretation and integration of relevant information from published and unpublished references, air photo interpretation and field investigations. Two major references used

TABLE 1

LEVELS OF CLASSIFICATION

Classification Level	Delineating Criteria	Scale of Derivation
1. Physiographic Region	Elevation, relief and structural geologic formations.	1:1 000 000 to 1:3 000 000
2. Physiographic Subregion	Definite patterns of relief, geology and geomorphology.	1:500 000 to 1:1 000 000
3. Geomorphic System	Recurring patterns of landforms distinguished by genetic composition (surficial material), and surface expression.	1:50 000 to 1:250 000
4. Geomorphic Unit	Homogeneous areas of land with inherent properties of genetic composition (surficial material), surface expression, texture, slope (type and %), aspect, (erosional and depositional modifiers), integration of soils (subgroup level CSSC) and internal drainage (CSSC).	1:5000 to 1:50 000

in the Sang Lake project were the Soil Survey and Land Evaluation of the Hinton-Edson Area (Dumanski et al, 1972) and Surficial Geology of the Edson-Hinton Area, Alberta (Roed, 1978).

Initial work involved the preliminary interpretation of the physical landscape for all four levels of classification on 1:21 120 black and white infrared aerial photography dated August 20, 1973. Two and a half days of field work from May 14 to 16, 1980 verified and supplemented the preliminary interpretation. Sample sites were chosen in areas representative of dominant geomorphic systems and units. Access into the study area was along cutlines by all-terrain vehicle and on foot. Pits and probes were dug at the sample sites to analyse the genetic composition of the surficial deposits, soil characteristics and drainage. The surface expression, slope and aspect were also determined at each site. Soils examined in the field were classified to the subgroup level as defined in The Canadian System of Soil Classification (CSSC), 1978. Mineral soil classification was based on such horizon characteristics as thickness, texture, structure, internal drainage, color, consistency, boundary features, presence of $CaCO_3$ and pH. Organic soils were not classified beyond the order level. A soil probe was used in additional sites to determine and verify the extent of various soil subgroups and parent material.

3. PHYSICAL LAND CLASSIFICATION

The Sang Lake grazing reserve occurs in the western limits of the Alberta Plains Physiographic Division (Figure 2) which for the purposes of this PLC is referred to as the Alberta Plains Physiographic Region. The study area is subdivided on the basis of definite patterns of relief, geology and geomorphology into the morainal upland and morainal-organic lowland physiographic subregions (Figure 4). Dominant geomorphic systems in both subregions fall into the morainal, organic and fluvial categories (Figure 4).

3.1 Alberta Plains Physiographic Region

The bedrock exerts a minor influence on the surface configuration of the terrain in the Sang Lake Grazing Reserve. A rounded ridge of Paskapoo sandstone outcrops at the surface outside the southeast corner of the study area. In the study area, terrain elevations rise from the northwest to southeast towards this ridge. Elevations in the study area range from 915 m above sea level (asl) in the northwest to slightly over 1 020 m asl in the southeast (Figure 3) giving a maximim relief of approximately 105 m. Local relief varies from less than five metres in the northwest portion of the study area to 20 to 30 m in the southeast. The entire study area is covered by surficial deposits laid down during and after continental glaciation.

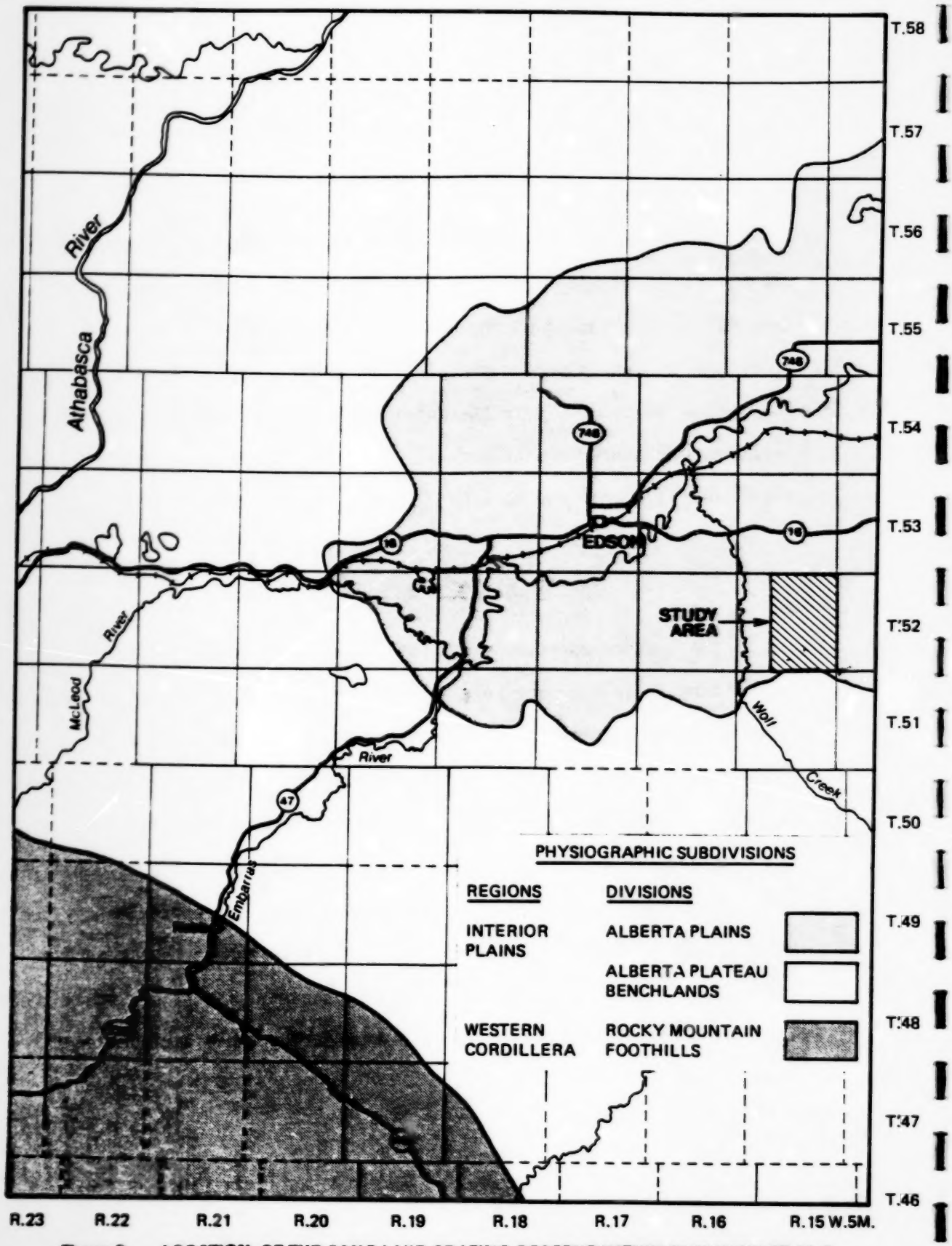

Figure 2. LOCATION OF THE SANG LAKE GRAZING RESERVE WITHIN DUMANSKI ET AL S (1972) PHYSIOGRAPHIC SUBDIVISIONS

3.2 Physiographic Subregions

Two physiographic subregions have been identified in the study area. These are the morainal upland and the morainal-organic lowland (Figure 4). The subregions are underlain by similar Paskapoo sandstones but differ in terms of their patterns of relief and geomorphology. The rolling morainal upland located in the southeast corner of the study area is overlain by fine textured Edson continental till which thins to a veneer over the ridge of Paskapoo bedrock a few kilometres beyond the southeast corner of the study area. The upland covers 16 km^2 which is roughly one quarter of the total study area. The remaining three quarters of the study area (46 km^2) consists of morainal-organic lowland. The lowland subregion has generally lower relief as expressed by the presence of level organic terrain which is randomly interspersed through undulating areas of Edson till.

3.2.1 Morainal Geomorphic System and Units

Morainal systems consisting of Edson till are found in both subregions. The till has a slightly stony, clay loam texture. The few cobbles and gravels found in the field pits were igneous which indicates the glacier which deposited the till originated in the Canadian Shield. This also confirms the glacier is continental in origin. The fine texture of the till matrix was derived from Upper Cretaceous shales which were incorporated into the continental ice mass moving in from the northwest. Tremendous

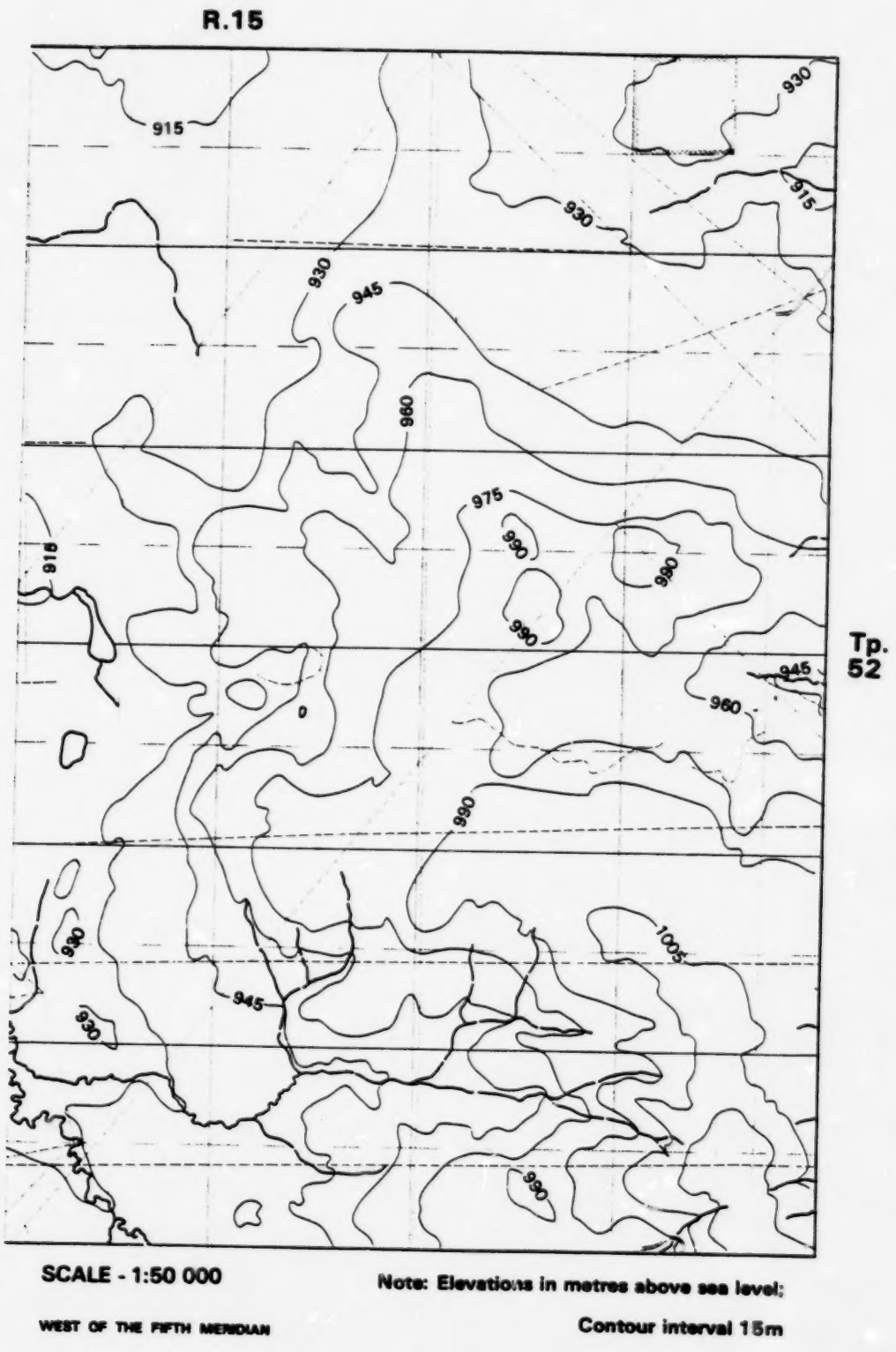

Figure 3. TOPOGRAPHIC EXPRESSION OF THE SANG LAKE STUDY AREA

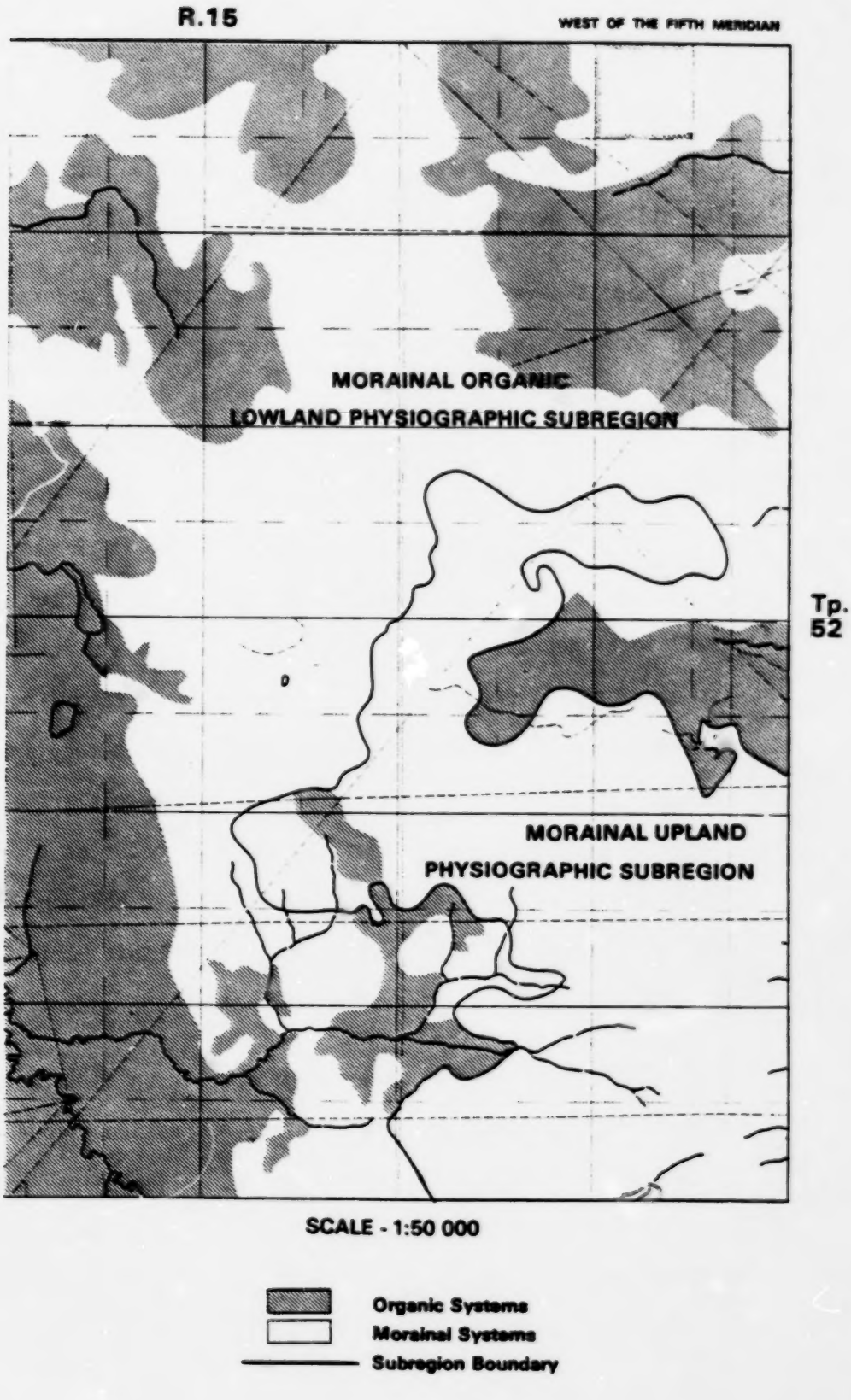

Figure 4. PHYSIOGRAPHIC SUBREGIONS AND GEOMORPHIC SYSTEMS

internal pressures pulverized the shaly material into fine textured deposits. The till was deposited from the base of the flowing continental ice mass.

Soils developed on these till deposits are moderately well drained. Water inflitrating through the solum has translocated clays from the A horizon into the B horizon resulting in the development of Orthic Gray Luvisols. These Luvisols are classified within the Hubalta series of Soil Survey (Dumanski et al, 1972). These soils have a characteristic platy, silt loam Ae horizon overlying a clay-enriched Bt horizon. Subdominant soils developed on poorly drained moraine are Orthic Luvic Gleysols in small local depressions and Orthic Humic Gleysols which often occur in association with organic soils. A typical soil catena on a poorly drained to moderately well drained slope sequence in the study area is schematically illustrated in Figure 5. The Orthic Luvic Gleysols are analogous to the Low Humic Eluviated Gleysols of the Erith association (Dumanski et al, 1972). These soils have a characteristic silt loam Aeg horizon underlain by a mottled Btg horizon in illuvial clays. The Orthic Humic Gleysols have diagnostic Ah horizons greater than 10 cm thick and underlying Bg and Cg horizons.

Differentiation of morainal geomorphic units in both subregions is primarily on the basis of local surface expression, slope and the proportion of well drained and poorly drained soils. All morainal units are similar in terms of their genetic composition and clay loam texture. In general, morainal units in the morainal-organic lowland are undulating and occasionally rolling, while in the morainal upland subregion there is an almost equal

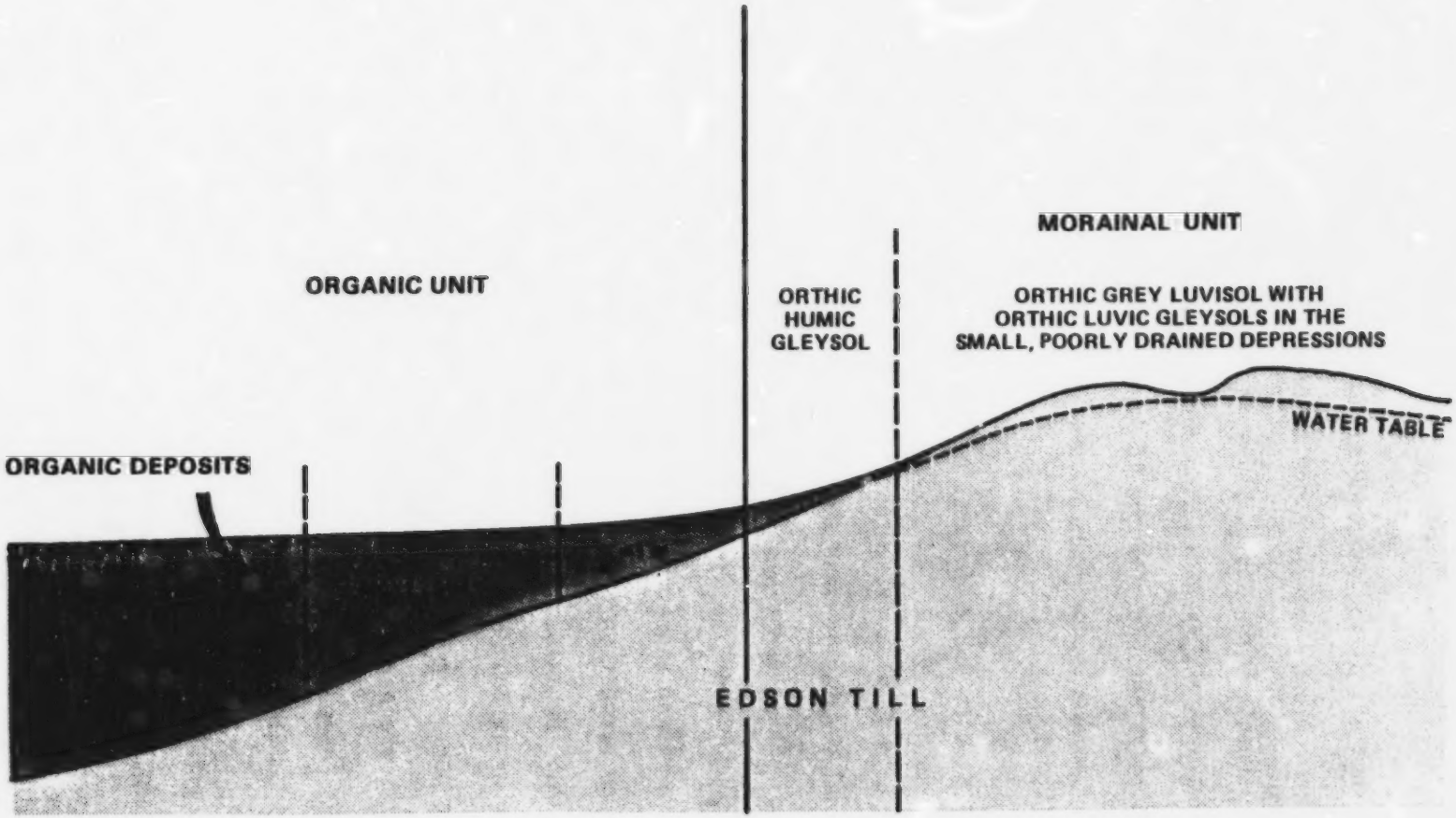

Figure 5. SCHEMATIC DISTRIBUTION OF TERRAIN AND SOILS IN AN ORGANIC UNIT TO MORAINAL UNIT SEQUENCE (NOT TO SCALE)

occurence of rolling and undulating terrain. Slopes in the morainal-organic lowland range from one to five percent in the north and three to nine percent in the south, while in the morainal upland local slopes are generally in the three to nine percent category and occasionally as high as 10 to 15 percent. In the lowland, there is a greater occurrence of poorly and very poorly drained soils than in the upland.

3.2.2 Organic Geomorphic System and Units

The organic system and associated units are most extensive in the morainal-organic lowland subregion and almost nonexistent in the morainal upland. The organic system in the lowland subregion is characterized by level, poorly drained organic deposits interspersed with small areas of moraine rising above the level organic terrain. Slopes are generally zero to three percent on organic terrain and as high as nine percent on morainal deposits. Organic thicknesses vary from greater than two metres in the centre of large depressions to thinner blankets and veneers over moraine in the periphery of these depressions. The very poorly drained organic deposits are partially decomposed which would put them in the Mesisol soil group. These Mesisols occur within the Fickle association of the Soil Survey (Dumanski et al, 1972). Organic deposits frequently thin out and grade into poorly drained Orthic Humic Gleysols.

The isolated areas of till in the midst of organic terrain are similar in terms of surface expression and soil characteristics to the units in the Upland and Lowland morainal systems.

A few fluvial units are found in the southern portion of the organic-morainal lowland subregion. These units represent narrow, linear floodplains formed by streams which flow west into Wolf Creek (located outside the study area). The streams originally drained waters to the west from shallow lakes (now occupied by organic deposits) which were formed shortly after deglaciation. The channels have been subsequently filled with poorly drained silty clay loam fluvial deposits and very poorly drained organic material. Surface expression in these units is level. The streams are presently slow moving and draw their water from the organic terrain. The poor drainage conditions and the deposition of sediments by frequent flooding have inhibited soil formation in the fluvial units. The resulting soil subgroup is a poorly developed and poorly drained Rego Gleysol. The sluggish nature of the streams have resulted in the establishment and growth of aquatic vegetation whose decayed remains have accumulated to form the organic soil. Soils developed on alluvium adjacent to organic areas are poorly drained Orthic Humic Gleysols.

GLOSSARY

A horizon: A mineral horizon formed at or near the soil surface in the zone of removal of materials in solution and suspension, or the zone of maximum in situ accumulation of organic carbon, or both.

Ae horizon: A layer of soil characterized by removal of clay, iron, aluminum or organic matter alone or in combination and higher in color value by one or more units when dry than an underlying B horizon.

Ah horizon: A layer of soil with organic matter accumulation which contains less than 17% organic carbon. It is one Munsell unit of color value darker than the layer immediately below, or has at least 0.5% more organic carbon than the parent material, or both.

Alluvium: Material such as clay, silt, sand and gravel deposited by modern rivers and streams. Synonymous with fluvial sediments.

Aspect: General direction toward which a slope faces.

B horizon: A mineral horizon characterized by one or more of the following: 1. An enrichment in silicate clay, iron, aluminum or humus.
2. A prismatic or columnar structure that exhibits pronounced coatings or staining associated with significant amounts of exchangeable sodium.
3. An alteration by hydrolysis, reduction or oxidation to give a change in color or structure from the horizons above or below, or both.

Basal moraine: Moraine carried at or deposited from the undersurface of a glacier.

Bedrock: Consolidated component comprised of elastic materials that are tightly packed or indurated. This includes igneous, metamorphic, sedimentary and consolidated volcanic rocks.

Blanket: A mantle of unconsolidated materials thick enough to mask minor irregularities in the underlying unit but which still conforms to the general underlying topography. A blanket ranges from 1 to 2 m in thickness.

Bog:	Sphagnum or forest peat materials formed under a nutrient-deficient environment due to the slightly elevated nature of the bog, tending to be dissociated from nutrient-rich ground water or surrounding mineral soils.
Bt horizon:	A horizon enriched with silicate clay, as indicated by a higher clay content (by specified amounts) than the overlying eluvial horizon, a thickness of at least 5 cm, oriented clay in some pores or on ped surfaces or both, and usually a higher ration of fine (less than 0.2 mm) to total clay than in the upper C horizon.
C horizon:	A mineral horizon comparatively unaffected by the pedogenic process operative in the A and B horizons, except for gleying and the accumulation of carbonates and more soluble salts.
Catena:	A sequence of soils about the same age, derived from similar parent materials and occurring under similar climatic conditions but having unlike characteristics because of relief and drainage.
Chroma:	The relative purity, strength or saturation of color which is directly related to the dominance of the determining wavelength of light. It is one of the three variables of color.
Clay loam:	Soil material which contains 27-40% clay and 20-45% sand.
Clay skins:	Coatings of oriented clays on the surfaces of soil peds and mineral grains and in soil pores.
Continental (Laurentide) glaciation:	Enormous ice sheets which covered much of North America during the Pleistocene epoch. These ice sheets are thought to have originated west and east of Hudson Bay and to have extended as far south as Illinois.
Deglaciation:	The stage of retreat of a widespread glaciation.
Eluviation:	The transportation of soil material in suspension or in solution within the soil by the downward or lateral movement of water.
Fen:	Sedge peat materials derived primarily from sedges with inclusions of partially-decayed stems of shrubs formed in a highly productive environment due to the close association of the material with mineral-rich waters.

Floodplain:	The land bordering a stream, built up of sediments from the overflow of the stream and subject to inundation when the stream is at flood stage.
g horizon:	A horizon characterized by gray colors or prominent mottling indicative of permanent or periodic intense reduction, or both; for example Aeg, Btg, Bg and Cg.
Glaciolacustrine:	Lake sediments deposited in contact with glacial ice.
Gleysolic:	An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas or prominent mottling or both in some horizons. The great groups Gleysol, Humic Gleysol and Luvic Gleysol are included in the order.
Gravel:	Rounded rock fragments 2 to 64 mm in diameter.
Gray Luvisol:	A great group of soils in the Luvisolic order occurring in moderately-cool climates where the mean annual temperature is usually lower than 5.5°C. The soils have developed under deciduous and coniferous forest cover and have an eluviated light-colored surface (Ae) horizon, a brownish illuvial B (Bt) horizon and usually a calcareous C horizon. The solum is base-saturated (NaCL extraction). The Ahe horizon, if present, is less than 5 cm thick. This group includes soils formerly called Gray Wooded.
Humic Gleysol:	A great group of soils in the Gleysolic order. A dark colored A (Ah or Ap) horizon more than 8 cm thick is underlain by mottled grey or brownish gleyed mineral (bulk density 0.1 or more) or up to 60 cm of fibric moss peat (bulk density less than 0.1) on the surface. This group includes soils formerly classified as Dark Grey Gleysolic and Meadow.
Illuviation:	The process of depositing soil material removed from one horizon in the soil to another, usually from an upper to a lower horizon in the soil profile. Illuviated substances include silicate clay, hydrous oxides of iron and aluminum, and organic matter.
Land classification:	The arrangement of land units into various categories based on the properties of the land or its suitability for some particular purpose.

Level:	A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than 1^{o}.
Luvic gleysol:	A great group os soils in the Gleysolic order developed under wet conditions, under grass of forest, or both. These soils have Aeg and Btg horizons.
Luvisolic:	An order of soils that have eluvial (Ae) horizons and illuvial (Bt) horizons in which silicate clay is the main accumulation product. The soils developed under forest or forest-grassland transition in a moderate to cool climate.
Mesozoic:	An era ranging in time from 230 to 70 million years, a duration of 160 million years. It comprises the Triassic, Jurassic and Cretaceous systems.
Moderately well drained:	The soil moisture in excess of field capacity remains for a small but significant part of the year.
Moraine:	Sediment generally consisting of well-compacted material that is non-stratified and contains a heterogeneous mixture of particle sizes, often in a mixture of sand, silt and clay which have been transported beneath, beside, on, within and in front of a glacier and not modified by an intermediate agent.
Mudstone:	Fine-grained, detrital sedimentary rock made up of silt and clay-sized particles. Distinguished from shale by lack of fissility.
Munsell color system:	A color designation system specifying the relative degrees of the three simple variables of color: hue, value and chroma. For example: 10YR 6/4 is the color of a soil having a hue of 10YR, value of 6 and chroma of 4. These notations can be translated into several different systems of color names.
Paleocene:	Lowermost division of the Tertiary Systems.
Parent geological material:	The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of a soil has developed by pedogenic processes.
Ped:	A unit of soil structure such as a prism, block or granule which is formed by natural processes. This is in contrast with a clod which is formed artificially.

Pleistocene:	Epoch immediately following the Pliocene and forming the lower part of the Quaternary period; it includes all time from one million years B.P. to the present.
Poorly drained:	The soil moisture in excess of field capacity remains in all horizons for a large part of the year.
Quaternary:	The latest period of time in the stratigraphic column, represented by local accumulations of glacial (Pleistocene) and post-glacial (Holocene) deposits which continue, without change of fauna, from the top of the Pliocene (Tertiary).
Regosolic:	An order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other orders. Regosol is the only great group in this order.
Rolling:	A very regular sequence of moderate slopes.
Sandstone:	A consolidated rock composed of rounded or angular sand grains cemented together. The grains are usually made up of quartz.
Sedimentary rock:	Rock composed of sediments which are formed through the agency of water, wind, glacial ice or organisms and are deposited at the surface of the earth at ordinary temperatures. The materials from which the rock is made must originally have come from the disintegration of older rocks, chiefly igneous.
Shale:	Lithified muds, clays and silts which are fissile and break along planes parallel to the original bedding. Shale is easily scratched and feels smooth.
Siltstone:	A very fine-grained consolidated clastic rock composed predominantly of particles of silt grade.
Silty clay loam:	Soil material that contains 27-40% clay and less than 20% sand.
Solum (pl. sola)	The upper horizons of a soil in which the parent material has been modified and in which most plant roots are contained. It usually consists of A and B horizons.
Subangular blocky:	Soil particles arranged around a point and bounded by flat or rounded surfaces. Faces are subrectangular, vertices mostly oblique or subrounded.

Subdued:	A group of linear and non-linear forms with slopes ranging up to 10^{0} with local relief greater than 1 m. This class is intended for use when there is little significance to distinguishing forms occurring on low relief. Such forms would include undulating, rolling, inclined, ridged and hummocky when they occur on slopes greater than 10^{0}.
Tertiary:	The earlier of the two subdivisions of the Cenozoic Era, preceding the Quaternary Period and extending from about 70 million years to about one million years ago.
Till:	Unstratified and unsorted glacial drift deposited directly by glacier ice.
Undulating:	A very regular sequence of gentle slopes which extend from rounded, sometimes confined concavities to broad, rounded convexities producing a wavelike pattern of low local relief. Slope length is generally less than 0.8 km and the dominant slope gradient is from 2-5%.
Veneer:	Unconsolidated materials too thin to mask the minor irregularities of the underlying unit. A veneer ranges between 10 cm and 1 m in thickness.
Very poorly drained:	Free water remains at or within 30 cm of the surface most of the year.

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